IUI4EUD: Intelligent User Interfaces for End-User Development

Keynote Talk Abstract

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ABSTRACT

End-User Developers program to meet some goal other than the code itself. This includes scientists, data analysts, and the general public when they write code. We have been working for many years on various ways to make end-user development more successful. In this talk, I will focus on two new projects where we are applying intelligent user interfaces to this long-standing challenge. In SUGILITE, the user can teach an intelligent agent new skills interactively with the user interfaces of relevant smartphone apps through a combination of programming by example (PBE) and natural language instructions. For instance, a user can teach SUGILITE how to order the cheaper car between Uber and Lyft, even though SUGILITE has no access to their APIs, no knowledge about the task domain, and no understanding of the concept “cheap” in advance. Another project, called Verdant, is focusing on helping data scientists, including those using Machine Learning and AI, to do exploratory programming. Verdant supports micro-versioning in computational notebooks for understanding the difference among the output and code of different versions, backtracking, provenance of output to its code, and searching the history. A goal for Verdant is to intelligently organize and summarize the raw history data to help data scientists make effective choices from it.

CCS CONCEPTS

- **Computing Methodologies** → **Intelligent Agents.**
- **Human-centered computing** → **Interactive systems and tools**

KEYWORDS

End-User Programming (EUP), End-User Development (EUD), End-User Software Engineering (EUSE), Exploratory Programming, Programming by Demonstration (PBD), Literate Programming, Version Control, Conversational Agents.

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BIOGRAPHY

Brad A. Myers is a Professor in the Human-Computer Interaction Institute in the School of Computer Science at Carnegie Mellon University. He was chosen to receive the ACM SIGCHI Lifetime Achievement Award in Research in 2017, for outstanding fundamental and influential research contributions to the study of human-computer interaction. He is an IEEE Fellow, ACM Fellow, member of the CHI Academy, and winner of 15 Best Paper type awards and 5 Most Influential Paper Awards. He is the author or editor of over 500 publications, including the books “Creating User Interfaces by Demonstration” and “Languages for Developing User Interfaces,” and he has been on the editorial board of six journals. He has been a consultant on user interface design and implementation to over 90 companies, and regularly teaches courses on user interface design and software. Myers received a PhD in computer science at the University of Toronto where he developed the Peridot user interface tool. He received the MS and BSc degrees from the Massachusetts Institute of Technology during which time he was a research intern at Xerox PARC. From 1980 until 1983, he worked at PERQ Systems Corporation. His research interests include user interfaces, programming environments, programming language design, end-user software engineering (EUSE), API usability, developer experience (DevX or DX), interaction techniques, programming by example, mobile computing, and visual programming. He belongs to ACM, SIGCHI, IEEE, and the IEEE Computer Society.

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Figure 1: With SUGILITE, users can give a command in natural language (left), and if the system does not understand, then the user can teach the system how to perform the task using a combination of programming-by-example (PBE) and natural language instructions in the context of third-party mobile app GUIs [6] to produce generalized scripts that can contain conditionals, exception handlers and parameters (right). SUGILITE supports programming Internet of Things (IoT) devices [8], specifying flexible data descriptions for demonstrated actions [7], and learning new concepts, such as the different interpretations of the concept “hot” as in “if an oven is hot” and “if the weather is hot” [9].

Figure 2: The Verdant tool [4] allows data scientists to explore their versions as part of their exploratory programming [3] in JupyterLab. It provides lightweight interactions for comparing, replaying, and tracing relationships among many versions of different code and non-code artifacts in the editor [2], since this is difficult and error-prone [5]. The history tab opens the sidebar for Verdant containing three tabs: Activity (A), Artifacts (B), and Search (C). The Activity tab, shown open here, displays a list of events. A date (D) can be opened or collapsed to see what happened each day. Each row shows a version of the notebook (e.g. version #53) with a text description and visual “minimap.” The minimap shows cells added in green (see G) and deleted in red (F). In (E), a cell was edited and run (in blue), and the following cells were run but remained the same (in grey). The user can open any version (e.g., #53, H) in a ghost notebook tab for quick reference. A previous version was called “Variolite” [1].

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